

ELITE ELECTRONIC ENGINEERING INCORPORATED
1516 CENTRE CIRCLE
DOWNERS GROVE, ILLINOIS 60515-1082

ELITE PROJECT: 29778

DATE TESTED: May 22, 2001

TEST PERSONNEL: Mark E. Longinotti, NARTE® Certified EMC Engineer
ATL-0154-E

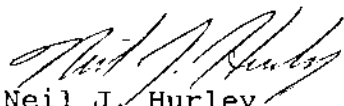
TEST SPECIFICATION: FCC "Code of Federal Regulations" Title 47
Part 15, Subpart C, Section 15.207 & 15.209

ENGINEERING TEST REPORT NO. 23790
MEASUREMENT OF RF INTERFERENCE FROM
A PROX READER (MOTOROLA) TRANSMITTER
MODEL BASIS

FOR: Best Access Systems, Inc.
Indianapolis, IN

PURCHASE ORDER NO.: 196412

Report By:


Neil J. Hurley
NARTE® Certified EMC Engineer
ATL-0149-E

Approved By:


Raymond J. Klouda
Registered Professional
Engineer of Illinois - 44894

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ADMINISTRATIVE DATA AND SUMMARY OF TESTS

DESCRIPTION OF TEST ITEM: Prox Reader (Motorola)

MODEL NO: BASIS

SERIAL NO: None Assigned

MANUFACTURER: Best Access Systems, Inc.

APPLICABLE SPECIFICATIONS: FCC "Code of Federal Regulations"
Title 47, Part 15, Subpart C

QUANTITY OF ITEMS TESTED: One (1)

TEST PERFORMED BY: ELITE ELECTRONIC ENGINEERING INCORPORATED
Radio Interference Consultants
Downers Grove, Illinois 60515

DATE RECEIVED: May 22, 2001

DATE TESTED: May 22, 2001

PERSONNEL (OPERATORS, OBSERVERS, AND CO-ORDINATORS):

CUSTOMER: Joel Sawaski of Best Access Systems, Inc. was present.

ELITE ELECTRONIC: Mark E. Longinotti

ELITE JOB NO.: 29778

ABSTRACT: The Prox Reader (Motorola), Model BASIS does meet the radiated emission requirements of the FCC "Code of Federal Regulations" Title 47, Part 15, Subpart C, Section 15.209 for Intentional Radiators, when tested per ANSI C63.4-1992.

The radiated emissions level closest to the limit (worst case) occurred at 125 kHz. The emissions level at this frequency was 53.5dB within the limit. See data page 15 for more details.

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WRITTEN APPROVAL OF ELITE ELECTRONIC ENGINEERING INCORPORATED.

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TOTAL NUMBER OF PAGES IN THIS DOCUMENT,
(INCLUDING DATA SHEETS): 15

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MEASUREMENT OF RF INTERFERENCE FROM
A PROX READER (MOTOROLA) TRANSMITTER
MODEL BASIS

1.0 INTRODUCTION:

1.1 DESCRIPTION OF TEST ITEM: This document presents the results of a series of radio interference measurements performed on a Prox Reader (Motorola) Transmitter, Model BASIS. (hereinafter referred to as the test item). No serial number was assigned to the test item. ~~The~~ test item was designed to transmit at approximately 125 kHz using an internal antenna. The tests were performed for Best Access Systems, Inc. of Indianapolis, IN.

1.2 PURPOSE: The test series was performed to determine if the test item meets the conducted and radiated RF emission requirements of the FCC "Code of Federal Regulations" Title 47, Part 15, Subpart C, Sections for Intentional Radiators. Testing was performed in accordance with ANSI C63.4-1992.

1.3 DEVIATIONS, ADDITIONS AND EXCLUSIONS: There were no deviations, additions to, or exclusions from the test specification during this test series.

1.4 APPLICABLE DOCUMENTS: The following documents of the exact issue designated form part of this document to the extent specified herein:

- Federal Communications Commission "Code of Federal Regulations", Title 47, Part 15, Subpart C, dated 1 October 2000
- ANSI C63.4-1992, "American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz"

1.5 SUBCONTRACTOR IDENTIFICATION: This series of tests was

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performed by Elite Electronic Engineering Incorporated of Downers Grove, Illinois. The laboratory is accredited by the National Institute of Standards and Technology (NIST) under the National Voluntary Laboratory Accreditation Program (NVLAP). NVLAP Lab Code: 100278-0.

1.6 LABORATORY CONDITIONS: The temperature at the time of the test was 21°C and the relative humidity was 32%.

2.0 TEST ITEM SETUP AND OPERATION:

A block diagram of the test item setup is included as Figure 1.

2.1 POWER INPUT: The test item was powered with 4 "AA" batteries internal to the test item enclosure.

2.2 GROUNDING: Since the test item was powered with 6VDC from 4 "AA" batteries, it was ungrounded during the tests.

2.3 PERIPHERAL EQUIPMENT: A proximity card was submitted with the test item to check for proper operation.

2.4 INTERCONNECT CABLES: No interconnect cables were submitted with the test item.

2.5 OPERATIONAL MODE: For all tests the test item was placed on a 80cm high non-conductive stand. The test item was energized.

For all tests, the test item was operated in the Active/Transmit mode. In this mode the test item was set to transmit continuously. The tests were performed with the test item operating at 125 kHz.

3.0 TEST EQUIPMENT:

3.1 TEST EQUIPMENT LIST: A list of the test equipment used can be found on Table I. All equipment was calibrated per the instruction manuals supplied by the manufacturer.

The fundamental, harmonics and spurious radiated emissions were measured with a spectrum analyzer. These measurements were taken with

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the resolution bandwidth of the measuring instrument adjusted to 100Hz below 150kHz and 10kHz from 150kHz to 30MHz.

3.2 CALIBRATION TRACEABILITY: Test equipment is maintained and calibrated on a regular basis. All calibrations are traceable to the National Institute of Standards and Technology (NIST).

3.3 MEASUREMENT UNCERTAINTY: All measurements are an estimate of their true value. The measurement uncertainty characterizes, with a specified confidence level, the spread of values which may be possible for a given measurement system.

The measurement uncertainty budgets were based on guidelines in "ISO Guide to the Expression of Uncertainty in Measurements" and NAMAS NIS81 "The Treatment of Uncertainty in EMC Measurements".

The measurement uncertainty for these tests is presented below:

Conducted Emission Measurements:

Combined Standard Uncertainty	1.07	-1.07
Expanded Uncertainty (95% confidence)	2.1	-2.1

Radiated Emission Measurements:

Combined Standard Uncertainty	2.26	-2.18
Expanded Uncertainty (95% confidence)	4.5	-4.4

4.0 REQUIREMENTS, PROCEDURES AND RESULTS:

4.1 POWERLINE CONDUCTED EMISSIONS:

4.1.1 REQUIREMENTS: All radio frequency voltages on the power lines of an intentional radiator shall be below 250uV (quasi-peak) over the frequency range from 0.45MHz to 30MHz. It is also to be noted that if emitted levels in the peak detector function do not exceed the above limits, the test item does meet the intent of these requirements.

Since the test item was powered by internal batteries, no conducted emissions tests were performed.

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4.2 RADIATED MEASUREMENTS:

4.2.1 REQUIREMENTS: The test item must comply with the requirements of FCC "Code of Federal Regulations Title 47", Part 15, Subpart C, Section 15.209.

Paragraph 15.209 has the following radiated emission limits:

Frequency MHz	Field Strength uV/m	Measurement Distance (m)
0.009-0.49	$2400/f(\text{kHz})$	300
0.49-1.705	$24000/f(\text{kHz})$	30
1.705-30	30	30
30-88	100	3
88-216	150	3
216-960	200	3
Above 960	500	3

4.2.2.1 PRELIMINARY RADIATED MEASUREMENTS: All preliminary tests were performed in a 17ft. x 12ft. x 8ft. test chamber.

The shielded enclosure prevents emissions from other sources, such as radio and TV stations from interfering with the measurements. All powerlines and signal lines entering the enclosure pass through filters on the enclosure wall. The powerline filters prevent extraneous signals from entering the enclosure on these leads.

The broadband measuring antenna was positioned at a 1 meter distance from the test item. The entire frequency range from 10kHz to 30MHz was investigated using a peak detector and automatically plotted. The frequencies where significant emission levels were noted were then remeasured at an open area test site.

4.2.2.2 FINAL RADIATED MEASUREMENTS: Final open field measurements were manually performed at Elite's open field test site located in Downers Grove, Illinois. The open field test site is located in a clear area and is equipped with a 1/4-inch wire mesh

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ground plane. The facility complies with the test site criteria in ANSI C63.4-1992 and Section 2.948 of the FCC Rules.

Measurements were performed at a test distance of 3 meters using a peak detector.

Since the test distance was reduced from either 300 or 30 meters to 3 meters, a correction factor was applied to the measurements. Radiation at 125kHz was measured at several distances and the levels plotted. A straight line was drawn through these points and the slope (which is the propagation loss constant) was calculated. Measurements and calculations are shown in Figure 2. The factors to correct levels at 3 meters to levels at 300 or 30 meters are shown on the data page.

The final open field emission tests were performed over the frequency range of 120kHz to 1500kHz. Between 120kHz and 1500kHz, a loop antenna was used as the pick-up device.

All significant broadband and narrowband signals were measured and recorded.

To ensure that maximum emission levels were measured, the following steps were taken:

- 1) Measurements were made using a peak detector and a loop antenna.
- 2) To ensure that maximum, or worst case, emission levels were measured, the following steps were taken:
 - (a) The test item was rotated so that all of its sides were exposed to the receiving antenna.
 - (b) Since the measuring antenna is linearly polarized, both horizontal and vertical field components were measured.
 - (c) The measuring antenna was raised and lowered from 1 to 3 meters for each antenna polarization to maximize the readings.

4.2.3 RESULTS: The preliminary plots, with the test item

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transmitting at 125kHz, are presented on data page 14. The plot is presented for a reference only, and are not used as official data.

The final open area radiated levels, with the test item transmitting at 125kHz, are presented on data pages 15. As can be seen from the data, all emissions measured from the test item were within the specification limits. The emissions level closet to the limit (worst case) occurred at 125.6kHz. The emissions level at this frequency was 53.5dB within the limit. See data page 15 for details. Photographs of the test configuration which yielded the highest, or worst case, radiated emission levels are shown on Figure 3.

5.0 CONCLUSION:

It was found that the Best Access Systems, Inc. Prox Reader (Motorola) Transmitter, Model BASIS does meet the radiated emission requirements of the FCC "Code of Federal Regulations" Title 47, Part 15, Subpart C, Section 15.209 for Intentional Radiators, when tested per ANSI C63.4-1992.

6.0 CERTIFICATION:

Elite Electronic Engineering Incorporated certifies that the information contained in this report was obtained under conditions which meet or exceed those specified in the test specification.

The data presented in this test report pertains only to the test item at the test date. Any electrical or mechanical modification made to the test item subsequent to the specified test date will serve to invalidate the data and void this certification.

7.0 ENDORSEMENT DISCLAIMER:

This report must not be used to claim product endorsement by NVLAP or any agency of the US Government.

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TABLE I: TEST EQUIPMENT LIST

ELITE ELECTRONIC ENG. INC.

Page: 1

Eq ID	Equipment Description	Manufacturer	Model No.	Serial No.	Frequency Range	Cal Date	Cal Inv	Due Date
Equipment Type: ANTENNAS								
NLS1	24" ACTIVE LOOP ANTENNA	EMCO	6502	8903-2329	0.01-30MHZ	12/27/00	12	12/27/01
Equipment Type: RECEIVERS								
RAE0	SPECTRUM ANALYZER	HEWLETT PACKARD	85660A	1904A00175	100HZ-22GHZ	01/05/01	12	01/05/02
RAF0	QUASIPeAK ADAPTER W/ REC1	HEWLETT PACKARD	85650A	2043A00115	0.01-1000MHZ	01/05/01	12	01/05/02

Cal. Interval: Listed in Months I/O: Initial Only N/A: Not Applicable

Note 1: For the purpose of this test, the equipment was calibrated over the specified frequency range, pulse rate, or modulation prior to the test or monitored by a calibrated instrument.

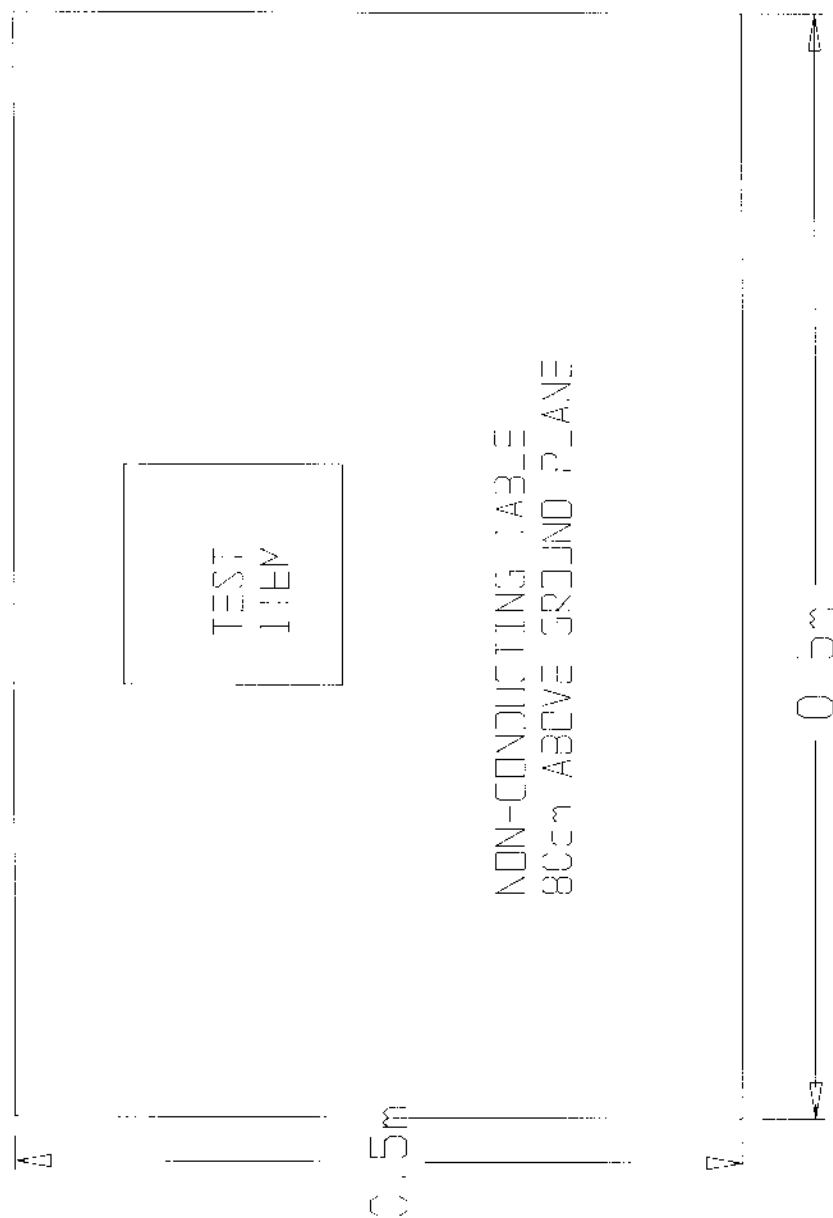


FIGURE 1 BLOCK DIAGRAM OF TEST ITEM AND PERIPHERAL EQUIPMENT SETUP
ETR 2379C

FIGURE 2

PROPAGATION LOSS MEASUREMENTS AND CALCULATIONS:

TEST DISTANCE METERS	METER READING dBuV
3	67.2
4	62.8
5	56.5
6	51.3

$$\text{PROPAGATION LOSS} = 20 * \text{LOG} (D_m/D_l)^N$$

WHERE : D_m = DISTANCE OF MEASUREMENT

: D_l = LIMIT DISTANCE

: N = SLOPE OF THE LINE

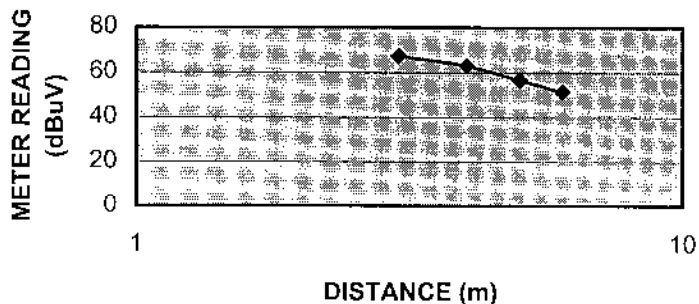
SOLVING FOR N :

$$N = (\text{dBV}_2 - \text{dBV}_1) / (20 * \text{LOG}(D_2/D_1))$$

$$N = (51.3 - 67.2) / (20 * \text{LOG}(6/3))$$

$$N = -2.64$$

PROPAGATION LOSS



PLACING THE SLOPE (N) INTO THE PROPAGATION LOSS EQUATION GIVES YOU:

PROPAGATION LOSS OF 105.6dB AT 300 METER TEST DISTANCE

PROPAGATION LOSS OF 52.8dB AT 30 METER TEST DISTANCE

FIGURE 3



TEST SETUP FOR RADIATED EMISSIONS MEASUREMENTS
MAXIMIZED FOR MEASUREMENT OF WORST CASE EMISSIONS
HORIZONTAL POLARIZATION

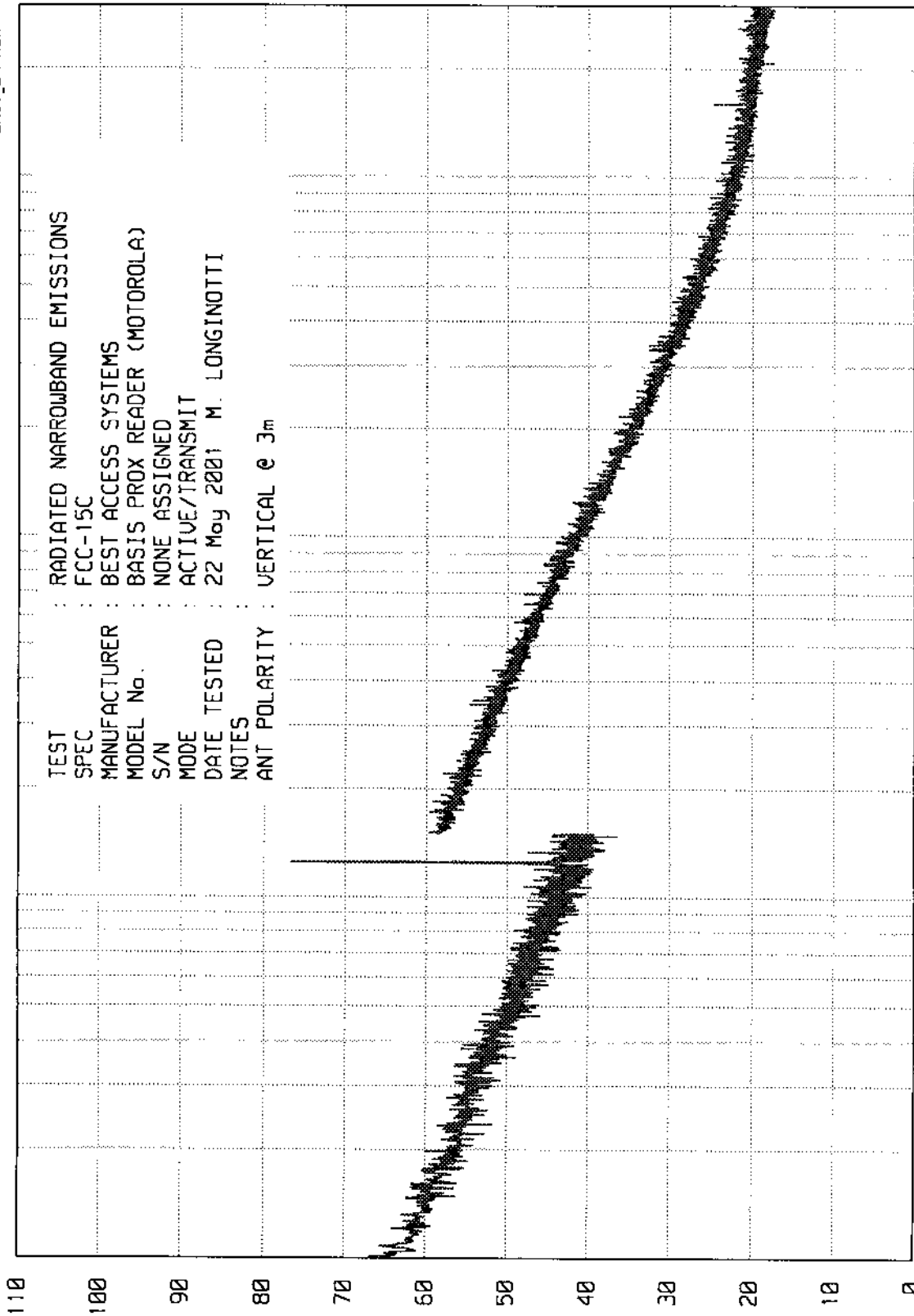


TEST SETUP FOR RADIATED EMISSIONS MEASUREMENTS
MAXIMIZED FOR MEASUREMENT OF WORST CASE EMISSIONS
VERTICAL POLARIZATION

ELITE ELECTRONIC ENGINEERING Co.
Downer's Grove, Ill. 60515

UNIU_EM RUN RUN 1

WKAB 05/03/01



RADIATED NARROWBAND EMISSIONS - dBu/m

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START = .01

FREQUENCY - MHz

10

1

STOP = 30



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ELITE ELECTRONIC ENGINEERING INC.

MANUFACTURER : BEST ACCESS SYSTEMS
 MODEL : BASIS PROX READER (MOTOROLA)
 S/N : NONE ASSIGNED
 SPECIFICATION : FCC-15C (15.209)
 DATE : MAY 22, 2001
 NOTES : TRANSMIT AT 125 kHz
 : PEAK DETECTOR, BW = 300 Hz BELOW 150 kHz, 10 kHz ABOVE 150 kHz

FREQ kHz	ANT POL	MTR	ANT	PROPAGATION		TOTAL	TOTAL	LIMIT
		RDG		FAC	LOSS			
		dBuV	AMBIENT	dB	dB	dBuV/m	uV/m	uV/m
125.0	V	67.5		10.3	105.6	-27.8	0.041	19.2
	H	58.1		10.3	105.6	-37.2	0.014	19.2
250.0	V	46.6	AMBIENT	10.2	105.6	-48.8	0.004	9.6
	H	45.3	AMBIENT	10.2	105.6	-50.1	0.003	9.6
375.0	V	56.8	AMBIENT	10.2	105.6	-38.6	0.012	6.4
	H	42.2	AMBIENT	10.2	105.6	-53.2	0.002	6.4
500.0	V	72.4	AMBIENT	10.2	52.8	29.8	30.903	48
	H	40.9	AMBIENT	10.2	52.8	-1.7	0.822	48
625.0	V	66.9	AMBIENT	10.3	52.8	24.4	16.596	38.4
	H	40.9	AMBIENT	10.3	52.8	-1.6	0.832	38.4
750.0	V	62.7	AMBIENT	10.3	52.8	20.2	10.233	32
	H	45.6	AMBIENT	10.3	52.8	3.1	1.429	32
875.0	V	66.3	AMBIENT	10.4	52.8	23.9	15.668	27.4
	H	49.6	AMBIENT	10.4	52.8	7.2	2.291	27.4
1000.0*	V	101.1	AMBIENT	10.4	52.8	58.7	860.994	24
	H	86.2	AMBIENT	10.4	52.8	43.8	154.882	24
1125.0*	V	71.6	AMBIENT	10.5	52.8	29.3	29.174	21.3
	H	49.8	AMBIENT	10.5	52.8	7.5	2.371	21.3

* - AM BROADCAST STATIONS ARE AT 1000 kHz AND AT 1110 kHz

CHECKED BY :